

2. Observations on the Parasphenoid, the Vomer, and the Palato-pterygoid Arcade. By J. BLAND SUTTON, F.R.C.S., Lecturer on Comparative Anatomy at the Middlesex Hospital Medical College.

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(Plates LIII. & LIV.)

In the well-known 'Lectures on the Elements of Comparative Anatomy,' 1864, Professor Huxley, in describing the structure of the Pike's skull, draws especial attention to a bone forming part of that fish's cranio-facial axis, which up to the time of the delivery of those admirable lectures had been denominated basi-sphenoid.

Concerning this bone the Professor states:—"It differs from any of the ossifications of the basi-sphenoidal cartilage in Man, not only by extending backwards beneath the basi-occipital, but by stretching forwards beneath the pre-sphenoidal and ethmoidal cartilages to within a short distance of the anterior extremity of the cranium; and in the still more important circumstance that it is an ossification within the perichondrium, which can be stripped off, in skulls which have been macerated, or steeped for a short time in boiling water, without injury to the cartilage upon which it is developed.

"Mr. Parker has shown, in his valuable paper on *Balaniceps*¹, that the so-called basi-sphenoid of birds is developed from three ossifications—a central one, the true basi-sphenoid, and two lateral and inferior centres, the 'basi-temporals' (Parker), which appear to correspond with the *lingulæ* of Man. The thought readily arises that the single bone *x* (Plate LIII. fig. 1) may correspond with these two basi-temporal ossifications. The latter, however, appear to be cartilage ossifications like the *lingulæ* themselves; and upon the whole I think it will be safer, at any rate for the present, to regard the bone *x* as peculiar to the branchiate Vertebrata and to confer upon it the special name of '*parasphenoid*'" (p. 170).

For twenty full years has the name *parasphenoid* found a place in anatomical nomenclature, and as such it will probably continue to do so, but that it is a bone peculiar to branchiate Vertebrata is an opinion unsupported by facts and altogether untenable. It is one of the objects of this paper to show that its representative in the skulls of Mammalia is the bone known as the "*vomer*."

It must of course seem presumption on my part to differ from Prof. Huxley on a subject to which he has devoted his critical mind for so many years; nevertheless, I ask for unbiassed attention, as for some years past the question has occupied my best thought and labour.

Stated briefly, the relations of the parasphenoid amount to these in the Pike's skull:—

It is a bone of membranous origin, having the shape and general appearance shown in Plate LIII. fig. 2. By its upper surface it is in relation with the under surface of the basi-occipital bone, the

¹ Trans. Zool. Soc. vol. iv.

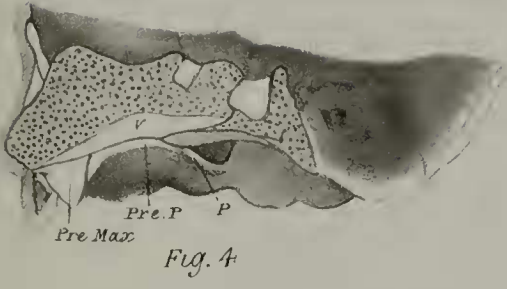


Fig. 4.



Fig. 2.

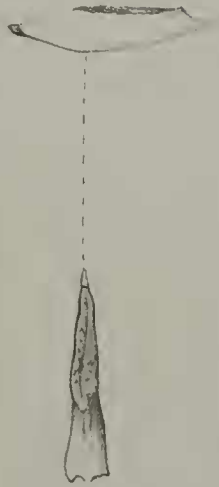


Fig 3.

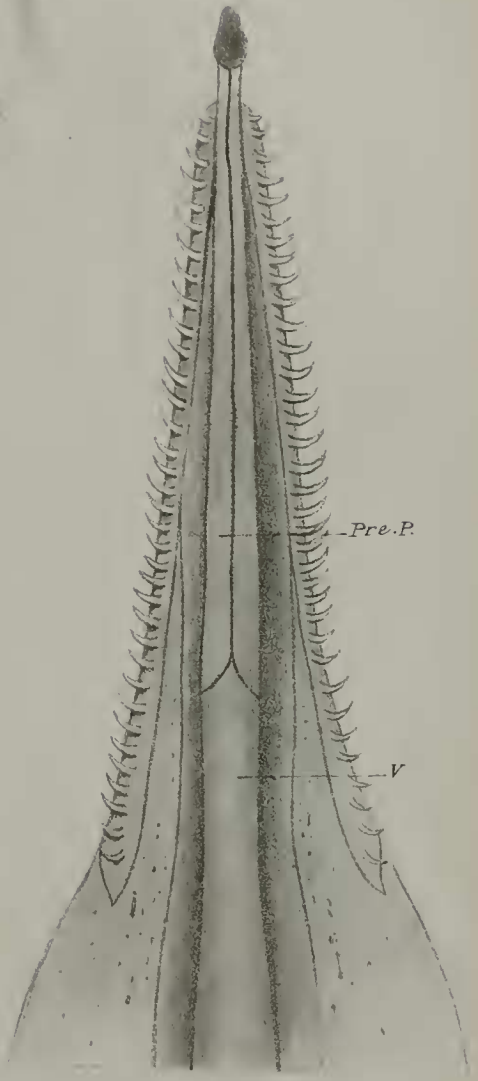


Fig. 5.

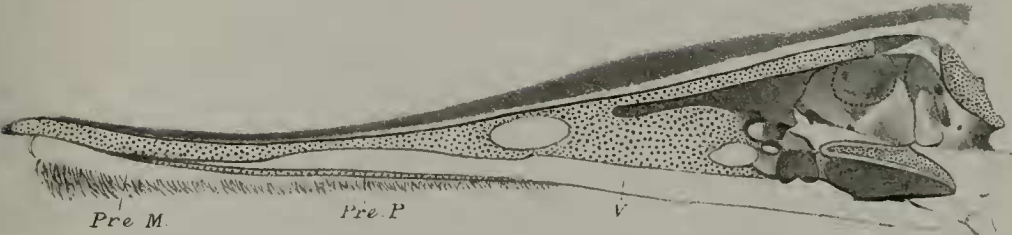


Fig 1.



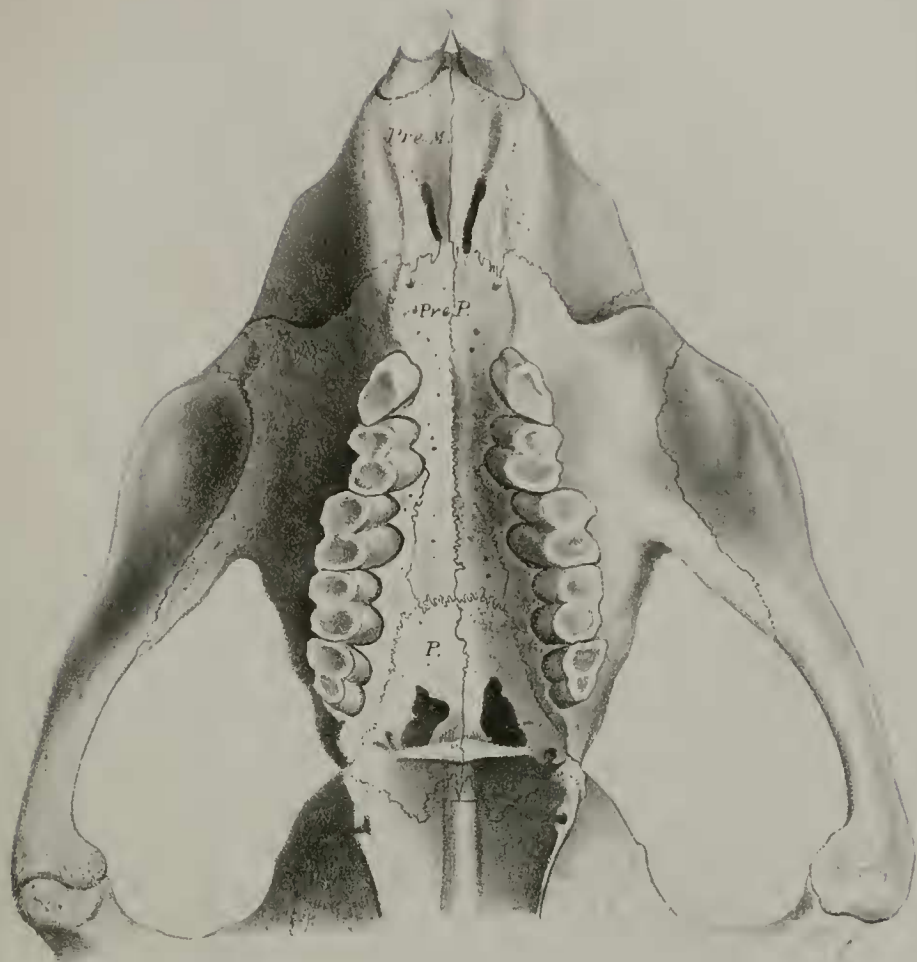


Fig. 7.

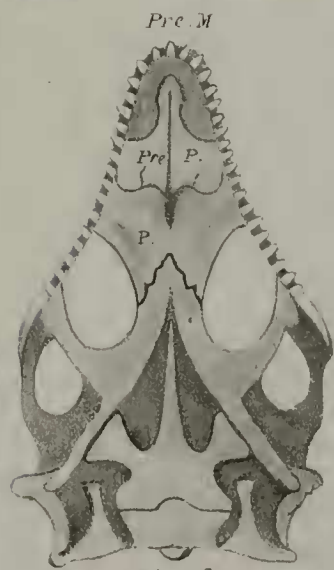


Fig 6.

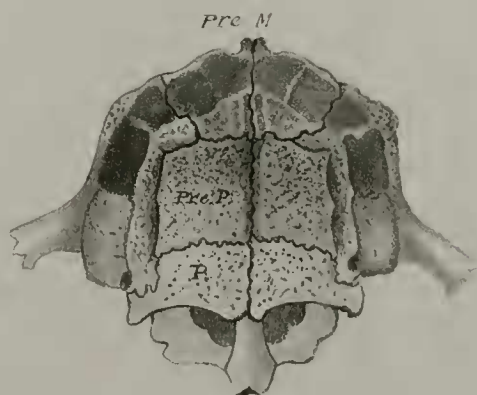


Fig. 8.



basi-sphenoid, and ethmoidal cartilage; it extends the whole length of the ethmo-vomerine cartilage, and at its anterior end *rests upon* a median-placed bone carrying teeth, and usually marked "*vomer*."

The vomer of a human foetus at the time of birth is represented in Plate LIII. fig. 3.

It arises from a single ossific nucleus which is deposited in the perichondrium covering the lower border of the ethmo-vomerine plate. It underlies the basi-sphenoidal and ethmoidal regions, and lodges the ethmo-vomerine cartilage in a shallow trough; anteriorly it ends by *resting on* two horizontal plates of bone, which in the usual condition of the parts constitute elements of the complex superior maxillary bone.

The vomer is represented *in situ*, Plate LIII. fig. 4, and the parasphenoid in fig. 1, where it will be observed that, so far as shape, situation, and relations go, the two bones correspond in a remarkable manner.

If, instead of taking a human foetus at birth, we examine one at an earlier stage, before the hard palate is completed, we shall find that the mouth and nasal fossæ form one common cavity, the vomer forms a partial covering to the ethmo-vomerine plate, and rests anteriorly on the premaxillæ. In this condition it still more strikingly compares with the Pike's parasphenoid. Indeed, its homology is self-evident. On the other hand, to make the Pike's parasphenoid compare with the vomer of a mammal at birth, it is only necessary to widen the bones forming the anterior part of the palato-quadrate arch so as to meet the parasphenoid, or, coalescing in the median line, shut it off from the buccal cavity.

To my mind the most important feature that surrounds the parasphenoid (vomer) seems to be this:—

In crania possessing no bony basi-occipital or ossified sphenoidal region in the base of the skull, this bone plays the part of a keel to the brain-case and face (in *Menobranchus* it constitutes the floor of the cranium), and forms an important element in the structure of the skull. As ossific nuclei begin to be deposited in the basal cartilage, such bones as the basi-occipital and the basi- and pre-sphenoid are support enough in themselves; thus the function of the parasphenoid (vomer) becomes abrogated and commences to lose its relatively great importance. Take for examples *Menobranchus*, *Siredon*, and *Siren*, all of which lack a basi-occipital bone; in each of these instances the parasphenoid (vomer) extends as far backwards as the anterior boundary of the foramen magnum. In the Pike, Cod, and such fish possessing an ossified basi-occipital, the vomer only ventures as far backwards as the anterior end of that bone, merely for greater support. Ascending the scale of vertebrates and gaining mammals, we find well-ossified bones in the skull's base, of cartilage origin, strong and capable supports for the skull-vault; and the vomer is reduced to slender and delicate proportions, merely performing the insignificant duty of forming a part of the septum between the neighbouring nasal passages.

In the skull of the Frog, however, this median parasphenoid

(vomer) stops short at, and does not pass beyond, the girdle-bone. In this case it is interesting to note that the anterior portion of the skull is in no need of extraneous support, for the girdle-bone sufficiently protects the ethmoid region, whereas the region between the occipital and girdle-bones is still only cartilaginous at the base, and requires support from the dagger-like parasphenoid (vomer).

The question then arises, If the parasphenoid of the Pike and the vomer of Man are homologous, to what do the bones marked vomers in the skull of fishes and batrachians correspond? This is a broad question, and involves a consideration of several facial bones. It is to me very obvious that no small amount of confusion with regard to the morphology of the bones of the anterior region of the fish's skull has arisen from the fact, that most anatomists, who have attempted to compare the skulls of the two extremes of vertebrate organization, have not taken sufficiently into account the mode of ossification of the superior maxillæ in mammals. This is necessarily of fundamental importance in its bearing on the question; and after the excellent results Professor Huxley obtained by applying this method of research in elucidating the morphology of the various parts of the temporal bone, I was induced to work out in the same way the facial region.

To attempt to give even a résumé of all that has been written on the subject of the ossification of the superior maxillary would be a labour in itself; therefore I shall content myself by saying that from the time of Portal onwards anatomists of eminence, who have devoted any attention to the matter, have maintained that this bone arises from more than one centre.

The bones are of membranous origin throughout. The various centres are deposited so nearly at one time, and grow so rapidly, that it is an exceedingly difficult matter to determine the order of their appearance; but this affects the general result so little that the description will be commenced by a consideration of the premaxillary portion.

It is certainly very remarkable that any anatomist should be so incredulous as to doubt the origin of this interesting element from an independent centre; but such is the fact, simply because the maxillo-premaxillary suture, so evident on the palatal aspect of skulls up to end of the first dentition, is obliterated very early on the facial surface of the bone, due to a deposition of osseous material from the periosteum. The segment may be thus described:—

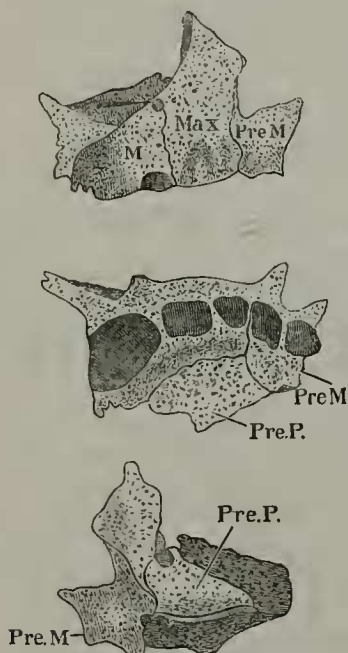
It comprises that portion of the superior maxilla which lodges the two incisor teeth; from its mesial surface a horizontal piece projects backwards to form the inner boundary of the anterior palatine canal. Superiorly it has a vertical portion, which forms the lower and outer boundary of the anterior nares, and in well-marked cases it sends up a spiculum to articulate with the nasal bone.

Dr. Paul Albrecht recently communicated to the Société d'Anthropologie de Bruxelles¹ a paper to the effect that the premaxillary bone is, as a matter of fact, developed from two centres, and supports his view by reference to cases of cleft-palate and hare-lip. I have

¹ October 1882.

examined some cases of cleft-palate and can support Albrecht's statements, but in the normal condition there is only one centre for each premaxillary bone. The discrepancy may be thus explained:—the premaxilla is originally developed in membrane, and at some little distance from the median line, which, in the fœtus, is occupied by the thick cartilage known as the ethmo-vomerine plate. After a time the premaxillary ossifications involve the anterior extremity of this cartilage, so that the inner portions of these bones are really of cartilage origin. If anything interfere to prevent the premaxillary bone or bones meeting the ethmo-vomerine plate, the tip of this cartilage ossifies on its own account, and gives rise to the false notion of two independent centres occurring normally. This fact may be verified easily in the majority of mammals. In other parts of the

Fig. 1.



Three views of the human superior maxilla, to visually express the disposition of its four ossific centres.

M. Malar centre, Max. Maxillary centre, Pre-M. Pre-maxillary, and Pre.P. Pre-palatine centres.

skull instances of a bone arising in membrane and invading cartilage might be quoted in support of my opinion.

The next centre to be considered forms the palate process of the maxilla and a considerable portion of the inner wall. Fig. 1 represents it as an L-shaped piece of bone, forming by means of its horizontal plate the roof of the mouth, whilst its vertical plate extends upwards as far as the orbital surface of the bone.

This centre will be referred to throughout this paper as the "pre-palatine" centre.